

troller and pump predictive model; therefore, the model may be substantially accurate with respect to predicting an assumed volume delivered.

[1135] However, in some embodiments of the infusion pump system, a series of one or more models may be established. For example, in some embodiments, for each disposable housing assembly, a code, or indication of the model, may be assigned based on a calibration procedure at manufacture. In these embodiments, therefore, each disposable housing assembly may not be explicitly calibrated to a specific reusable housing assembly, however, the calibration procedure may fit the disposable housing assembly into a category or code that most closely represents the expected performance based on the calibration procedure.

[1136] Thus, in some embodiments of these embodiments of the infusion pump system, the displacement of the pump plunger 2902, as discussed above, may follow a trajectory. The at least one optical sensor may determine the actual displacement of the pump plunger 2902 and the volume delivered may be assumed/predicted based on a model. In various embodiments, the pump plunger 2902 may include one or more optical sensors to determine the displacement of the pump plunger 2902. Examples of the optical sensors and the placement of these optical sensors may include those described above with respect to FIGS. 145-149B.

[1137] In some embodiments, variations in the disposable housing assembly, for example, SMA wire actuation and membrane spring back/return to starting position following pump, etc., may be accounted for in a predictive model. Thus, in some embodiments, the number of actuations of the pump plunger 2902 may translate to a variation in the feed forward term to compensate for a change in the prediction of the ADC counts to pump plunger 2902 displacement. In some embodiments, the SMA wire may vary upon use, and/or the membrane of the pump chamber 2916 may vary upon use, and therefore, the assumed volume of fluid pumped from the reservoir 2918 for a pump plunger 2902 displacement may vary with the number of pump actuations. In some embodiments, as the volume in the reservoir is depleted, the expected volume delivered for ADC count may vary, and therefore, the volume in the reservoir at the start of the pump may be factored into the one or more models.

[1138] In some embodiments, the actual displacement of the pump plunger 2902 upon actuation may vary from the trajectory. The volume controller may feed back the actual pump plunger 2902 displacement information, sensed by the at least one optical sensor. The difference between the displacement requested and the actual displacement may be fed into one or more of the upcoming deliveries, therefore, compensating for a displacement error.

[1139] Thus, the displacement of the pump plunger 2902 may, in some embodiments, essentially be translated into an assumed/presumed volume delivery. Using the at least one optical sensor, the actual displacement of the pump plunger 2902 for each actuation of the pump plunger 2902 may be determined. The displacement may be fed back to the target pump plunger 2902 displacement, and the volume controller may determine whether and how to compensate for the actual displacement, if determined necessary. In some embodiments, as discussed above, the pump plunger 2902 displacement, and in some embodiments, taken together with the number of actuations of the pump plunger 2902 for

a given disposable housing assembly, as well as the reservoir volume, may determine the volume delivered based on a model.

[1140] In some embodiments, whether and how to compensate for the determined actual displacement of the pump plunger 2902 may depend on one or more factors. These may include the size of the difference, whether the difference may indicate an over delivery or an under delivery, the number of consecutive actual displacement readings that may show error, etc. Thus, in some embodiments, a threshold error may be required prior to the controller adjusting the displacement trajectory.

[1141] In some embodiments of these embodiments of the infusion pump system, the system may include additional optical sensors to sense the movement of valves. For example, in some embodiments, the pump system may include at least one optical sensor to sense the movement of the reservoir valve 2904 and/or a pump chamber exit valve 2906, which may be similar to the valves described and shown above, for example, with respect to FIG. 150. The pump chamber exit valve 2906 may function in a similar manner to the volume measurement chamber valve 2906, only the pump chamber exit valve 2906, once opened, may allow fluid to flow from the pump chamber 2916 to the tubing set 2922. Thus, as discussed above, in these embodiments, the volume measurement sensor assembly 2946, together with the measurement valve, may be removed from the pump system 2900.

[1142] Thus, in these embodiments, confirmation of the valves 2904, 2906 opening and closing may confirm fluid was pumped from the reservoir 2918 and fluid was pumped out of the pump chamber 2916 and to the tubing set 2922. Following, where the optical sensors do not sense the opening and/or closing of one or more valves, the system may post an alarm. However, as discussed above with respect to various alarms posted to the system, in some embodiments, the alarms may be posted after a threshold is met. For example, in some embodiments, an alarm may be posted if the optical sensor determines that two consecutive pump plunger 2902 actuations occurred and two consecutive errors were detected on one or more of the valves 2904, 2906.

[1143] As discussed above with respect to the at least one optical sensor for the pump plunger 2902, in some embodiments, greater than one optical sensor may be used to collect sensor input from redundant optical sensors. In some embodiments, for example, as shown in FIG. 147, the two optical sensors for the pump plunger 2902 may be located in two different locations in the pump system 2900 thereby collecting sensor data from two different angles which may provide, in some embodiments, a more developed determination of the pump plunger 2902 displacement.

[1144] In some embodiments, the two or more optical sensors may be used for redundancy and also, to determine whether one of the optical sensors may have an error. Thus, in some embodiments, upon collection of optical sensor data from two or more optical sensors, the system may, comparing the two sets of data, determine that one of the sensors may have an error as the data points vary more than a preset threshold. However, in some embodiments, where the optical sensor data collected by the at least one optical sensor is so far away from the expected value, i.e., exceeds one or more thresholds, the system may post an alarm and conclude the at least one optical sensor has failed and/or is in error.